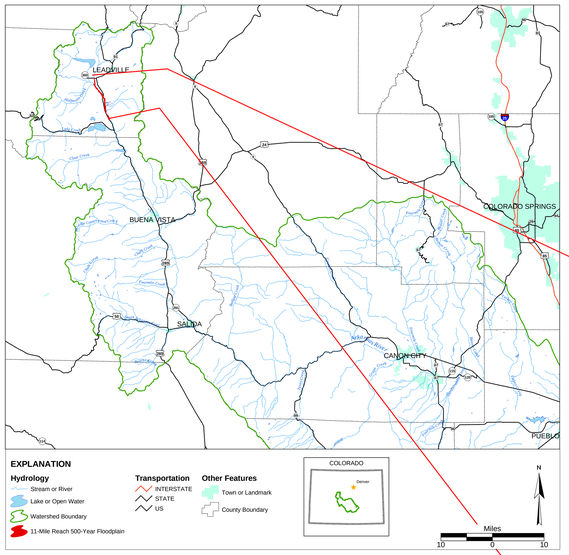
UPPER ARKANSAS RIVER
COOPERATIVE NATURAL RESOURCE DAMAGE ASSESSMENT
Between: State & Federal Trustees, EPA and the Mining Companies

Site Location Within Watershed

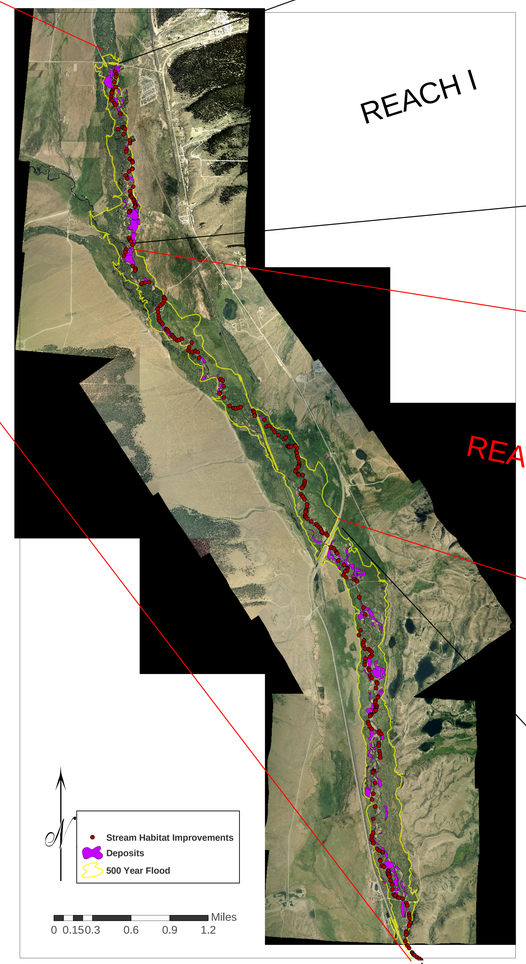


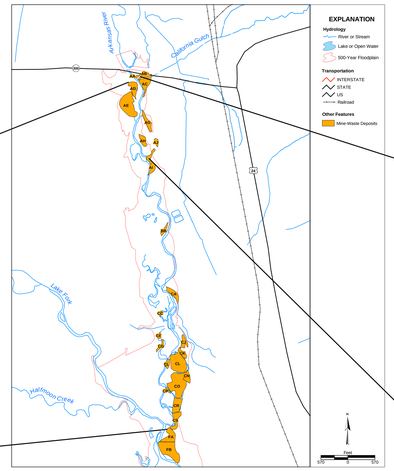
Historical Mining Operations Causes Current Injury

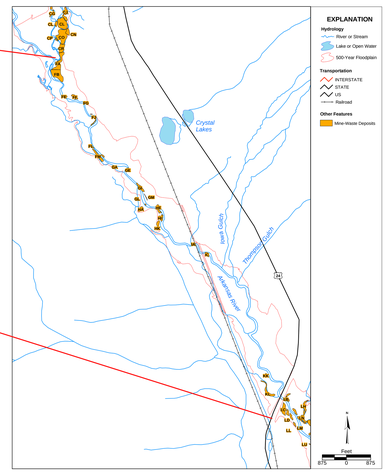
Leadville Looking West circa 1900

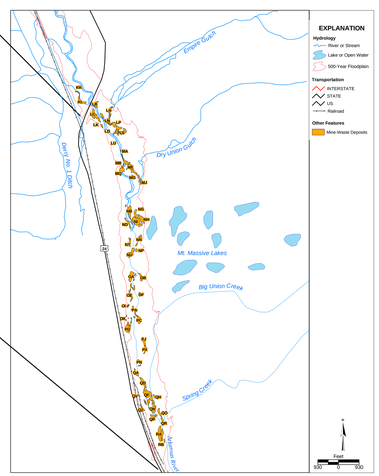
Leadville Looking West 2003

11 Mile Reach









California Gulch Above Leadville 1890's

Leadville Looking East 1890's

The Problems:

Mining Caused Acid Rock Drainage to Arkansas River

Fluvial Deposited Mine Waste Material

INJURY ASSESSMENT MATRIX

SURFACE WATER	SEDIMENTS	GROUNDWATER	FLOODPLAIN SOILS	SOILS WHERE FLOODPLAIN FLUVIAL MINE-WASTE DEPOSITS EXIST
1. Has the resource been injured: Yes 2. Description of Injury: Exceedence of the Table Value Standards (TVS) for Cd, Cu, Pb and Zn. Average dissolved zinc concentrations during Period 3[1] are 4 and 5 times higher than TVSs during high and low flow, respectively. 3. Source of Injury: Runoff from historic mine sites contributes metals in Reach 3. On average, water quality upstream of Reach 1 is typically near the TVSs. Inflow from California Gulch at the top of Reach 1 is responsible for large increases in in-stream metals concentrations measured throughout Reach 1. 4. Extent of Injury: Surface water is injured throughout Reach 1. Although substantial exceedences of the TVSs continue to occur, water quality has improved compared to pre-1992 conditions. Improvements are due to treatment of discharges from the Leadville Mine Drainage Tunnel on the East Fork of the Arkansas River, the Yak Tunnel on Upper California Gulch, and ongoing remediation at the California Gulch Superfund site.	1. Has the Resource Been Injured: Yes. 2. Description of Injury: Elevated concentrations of cadmium, copper, lead and zinc in sediments are found when compared to sediments in Reach 0. See benthic organisms for additional information. 3. Source of Injury: Metals transported to the river by surface waters and through overland runoff and erosion of mine wastes. Primary source area is California Gulch. 4. Extent of Injury: Metals data in sediments are very limited. The 11-Mile Reach of the Arkansas River is considered to be a sedimentary system. Fine sediments have a relatively short residence time in the 11-Mile Reach and only tend to be deposited in areas of reduced water velocities. Recent data indicate a reduction in sediment metals concentrations compared to prior periods. However, metals concentrations in fine-grained sediments continue to be elevated throughout Reach 1.	1. Has the Resource Been Injured: No. 2. Description of Injury: Although concentrations of cadmium exceed the drinking water Maximum Contaminant Level (MCL) and zinc exceeds the secondary MCL, the exceedences are not influencing drinking water supplies. Elevated metals concentrations in shallow ground water are not causing injury to surface water. 3. Source of Injury: Contaminated surface water exchange between surface and subsurface flows. Leaching of metals has increased concentrations in ground water adjacent to fluvial deposits. 4. Extent of Injury: Elevated metals concentrations in shallow ground water (<10 feet depth) decrease rapidly with depth and horizontal distance from a given mine-waste deposit. Discharge of shallow ground water with elevated metals concentrations to the Upper Arkansas River has no measurable effect on in-stream concentrations.	1. Has the Resource Been Injured: No. However, the potential for unacceptable exposure risks to wildlife and/or phytotoxicity were identified by EPA for localized areas of irrigated meadows. 2. Description of Injury: Total metal concentrations in floodplain (riparian) soils are substantially higher than concentrations found in Reach 0. However, plant-available concentrations are in a similar range to concentrations in Reach 0 and lower than concentrations considered to be toxic to plants (see vegetation). However, some localized areas of elevated soil metals concentrations in irrigated meadows were identified by US EPA as potentially posing increased risks to wildlife and/or phytotoxicity. 3. Source of Injury: No injury, although metal concentrations are elevated in floodplain (riparian) soils and these metals are most likely from historic flooding and irrigation activities. 4. Extent of Injury: Soil metal concentrations are elevated throughout Reach 1, but generally below concentrations considered tobe toxic to plants. 34.4 floodplain and non-floodplain acres were identified as posing the greatest potential risks.	1. Has the Resource Been Injured: Yes. 2. Description of Injury: Metal concentrations in fluvial mine-waste deposits exceed toxicity thresholds for plants and plant growth has been substantially reduced on most sites where fluvial mine-waste deposits occur. Of 24 deposits along Reach 1, 14 have poor vegetation cover (10% cover), 9 deposits have fair vegetation cover (10-50% cover) and 1 deposit has good vegetation (>50% cover). 3. Source of Injury: Fluvial deposition of mine-waste material during flood events. 4. Extent of Injury: Fluvial mine-waste deposits cover a surface area of approximately 18 acres, with a volume of approximately 887,000 cu. ft. Of the 24 deposit groups in this reach, 11 are ranked as a high priority for restoration, 11 are ranked as moderate priority, and 2 are ranked as low priority. The potential for these deposits to influence metals concentrations in both surface water and ground water is limited by the shallow thickness of the deposits and corresponding small loading potential relative to the large volume of surface and ground water moving through the valley.

VEGETATION	BENTHIC ORGANISMS	BROWN TROUT	SMALL MAMMALS	MIGRATORY BIRDS
1. Has the Resource Been Injured: Yes. 2. Description of Injury: Cover, biomass, and number of species of plants growing on floodplain (riparian) soils in Reach 1 are equal to or greater than Reach 0. All tissue metal concentrations are below thresholds considered to be toxic to perennial species. However, vegetation has been injured where most fluvial mine-waste deposits occur (see fluvial mine-waste deposits). 3. Source of Injury: Available data does not indicate injury to vegetation growing on floodplain (riparian) soils. Source of injury is limited to elevated metals in fluvial mine-waste deposits. 4. Extent of Injury: Injury to vegetation is limited to fluvial mine-waste deposits where vegetation cover is less than 50%.	1. Has the Resource Been Injured: Yes. 2. Description of Injury: Reduced abundance and species richness of benthic macroinvertebrates; elevated metal levels in periphyton. 3. Source of Injury: Elevated metal levels in water and periphyton from California Gulch. 4. Extent of Injury: Benthic macroinvertebrate communities are severely degraded in Reach 1. Greatest effects are observed during spring runoff.	1. Has the Resource Been Injured: Yes. 2. Description of Injury: Greatly reduced abundance and biomass. 3. Source of Injury: Elevated metal concentrations in water and benthic macro invertebrates from California Gulch. 4. Extent of Injury: Fish populations in Reach 1 are characterized by reduced abundance, biomass and very poor recruitment. A recently published report by Nehring & Policky 2002 evaluated trends in trout populations over the last 16 years. This report indicates continued improvement in brown trout fishery. It states that if this trend continues over the next several years, it may be strong empirical evidence that the efforts at ameliorating heavy metal pollution are beginning to have a positive effect on the trout population.	1. Has the Resource Been Injured: No. 2. Description of Injury: Based on comparisons of exposure data (vegetation & soils) from Reaches 0, 2 and the NPL Site, potential exposure in Reach 1 would not result in injury to small mammals. Tissue concentrations and pathology data from the NPL Site and Reach 2 (representing higher areas of exposure) did not show indications of injury. 3. Source of Injury: There are no specific data for Reach 1. Exposure would occur primarily via the food chain and soils. 4. Extent of Injury: Existing data are for herbivorous small mammals. Insectivorous small mammals may be exposed to higher metal concentrations, but they are also more tolerant of metals exposure and injury is not expected to occur.	1. Has the Resource Been Injured: Yes. 2. Description of Injury: Possible elevated lead tissue concentrations and suppressed ALAD. 3. Source of Injury: Aquatic invertebrates. 4. Extent of Injury: Because birds move between reaches, it is assumed that metals exposure in Reaches 2 and 3 are representative of the typical metals exposure throughout the 11-Mile Reach.

Source: Restoration Alternatives Report, Consulting Team 2004

MOU Process

UPPER ARKANSAS RIVER BASIN (LEADVILLE, COLORADO)

Site Description

The Upper Arkansas River Basin is being directly impacted by historical mining activities of the Leadville mining district. The Leadville area is included in the California Gulch Superfund Site, listed on the NPL in 1983. The study area for the Arkansas River is from the confluence with California Gulch (near the town of Leadville) downstream to and including the Pueblo Reservoir approximately 165 river miles. The immediate area of concern is known as the 11 Mile Reach and is defined as the 500 year floodplain beginning at the confluence of the Arkansas River and California Gulch and extending downstream for approximately 11 miles. This 11 Mile Reach generally suffers from sediment and tailing deposits generated from historical mining activities and poor water quality generating from the Leadville district and from the downstream tailing deposits and consists of elevated metals primarily arsenic, cadmium, lead and zinc along with low pH.

Background/History of NRDA/Cooperative Assessment:

The State of Colorado filed a Natural Resource Damage Claim against several mining companies in 1983 for injuries to state trust natural resources for ongoing releases of hazardous substances from historic mining activities in the Leadville mining district. The Environmental Protection Agency (EPA) placed the California Gulch Site on the NPL also in 1983. In 1994 a consent decree divided the NPL site into twelve operable units that are portioned into both enforcement and fund lead operable units. Having completed much of the work identified in the 1994 consent decree, the mining companies were interested in identifying and settling all liabilities under CERCLA (specifically NRD) and approached the State and federal Trustees indicating that they were interested in a cooperative approach to assessing injury to natural resources in order to identify all future liabilities. In 1999, a Memorandum of Understanding (MOU) was entered into among the State and federal Trustees, the EPA, and two mining companies. The MOU outlined a process in which the parties agreed to retain an independent group of scientists called the Upper Arkansas River Natural Resources Restoration Consulting Team (CT) for the purposes of performing an evaluation of all existing data in order to identify the nature and extent of injury to natural resources and to evaluate restoration alternatives for the identified injured resources within the 11 Mile Reach. The process outlined in the MOU is designed to coordinate both restoration of natural resources and remedial activities for a portion of the California Gulch Site with a goal of providing a basis for a negotiated settlement of all CERCLA liabilities (including NRD) due the mining companies for the entire site. The evaluation is to be focused on existing data and any new data that is collected consistent with the Superfund process. The selection of restoration projects is to be determined by the trustees in conjunction with the mining companies and EPA.

Details of Cooperation:

Work at the California Gulch Superfund Site has been ongoing 20 years. This includes remedial investigation, feasibility study and remedial action work on 12 operable units and other non-superfund monitoring work conducted by the State Division of Wildlife (DOW) on aquatic life in the Arkansas River downstream of the site. During this time significant data has been generated. The MOU parties agreed that the existing data would provide a substantive basis to determine the injuries to natural resources from the release of hazardous substances from the NPL site. It was also understood that there were a few known areas where there was insufficient data and that, by coordinating data gathering efforts to answer both remedial and restoration questions, many efficiencies could be gained. Therefore the new data gathering activities were designed jointly among EPA and the other MOU parties. This process of coordinating data efforts was also utilized in the ongoing data gathering activities of the Colorado Division of Wildlife (DOW) and the mining companies. The result has been the gathering of data arrays which are wider in scope and that the data generated is more compatible for the purposes of data sharing.

Significant Benefits & Lessons Learned:

The MOU process is still ongoing. Major lessons learned included the need to design data gathering efforts in a manner such that data formats can be easily shared among parties, including the fact that sampling station location-identifiers should each be unique and not duplicated across the site. The Upper Arkansas River Site Characterization Report, which identified the nature and extent of natural resource injuries was released in October 2002, and the Upper Arkansas River Restoration Alternatives Analysis report has now been completed. In order to add to the efficiency of editing and provide assistance with other aspects of document preparation , the process should have included a technical editor. Doing so would have speeded completion of the injury assessment report.

Contacts for Information:

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Vicky Peters, CO Attorney General Office, 303-866-5068
Laura Coppock, U.S. Fish and Wildlife Service, Colorado Field Office, Denver, CO, 303-275-2354

WEB SITES:
http://www.ago.state.co.us/EVIRON/uaridx.htm OR
http://mountain-prairie.fws.gov/nrda/CaliforniaGulch.htm

Potential Restoration Methods

Photo 8:

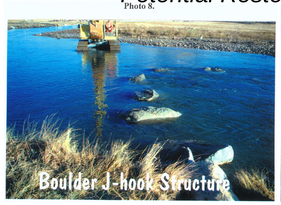
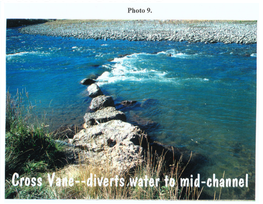


Photo 9.



Colorado Department of Public Health and Environment

HAZARDOUS MATERIALS & WASTE MANAGEMENT DIVISION